PD In Diabetic Patients

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Agenda

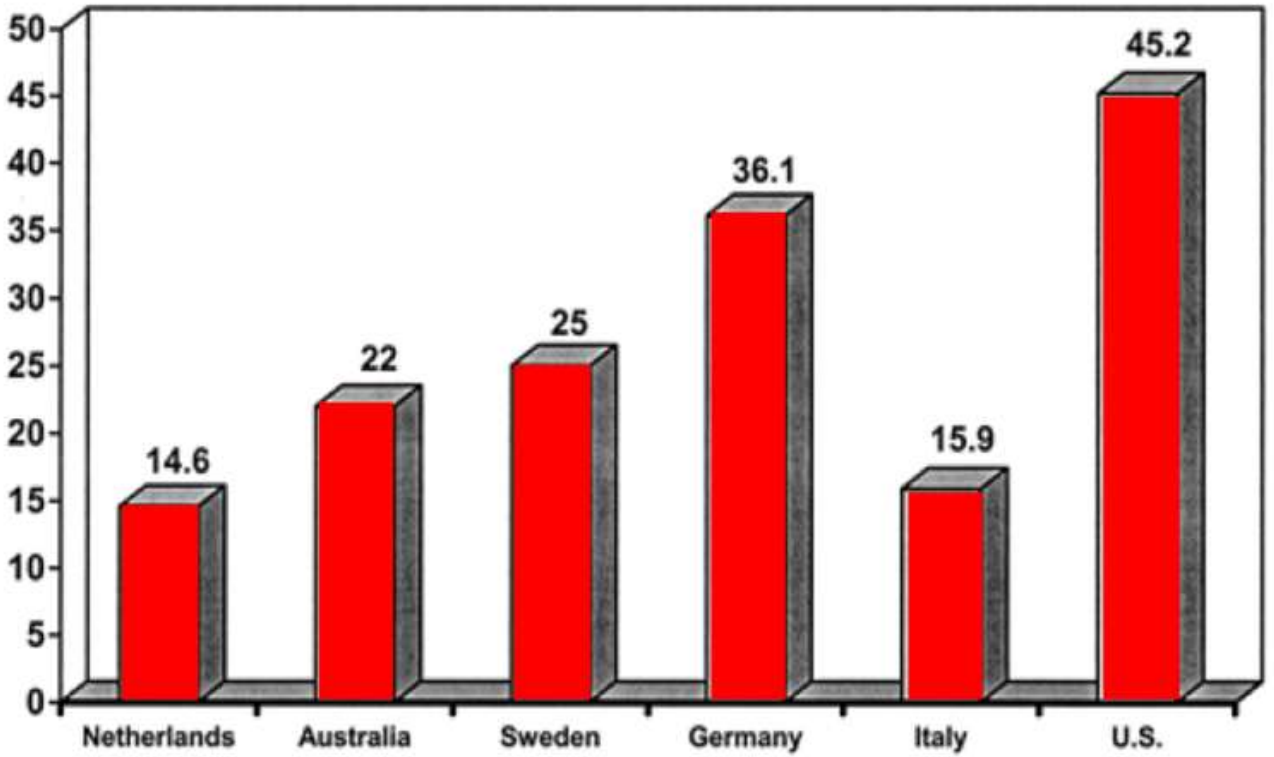
- **Introduction**
- **PD in diabetic Patients :**
  - ✓ **PD membrane**
  - ✓ **PD Fluids**
  - ✓ **Education**
  - ✓ **Potential advantages**
  - ✓ **Concerns**
- Insulin requirements in PD
- **Conclusion**

Diabetes mellitus: facts

- By the year 2030 366 million people (4,4% vs. 2,8% now)
- Caused by genetic, environmental factors, chronic subclinical inflammation
- Enhanced cardiovascular morbidity and mortality: especially in females

About one third of the new patients receiving dialysis treatment

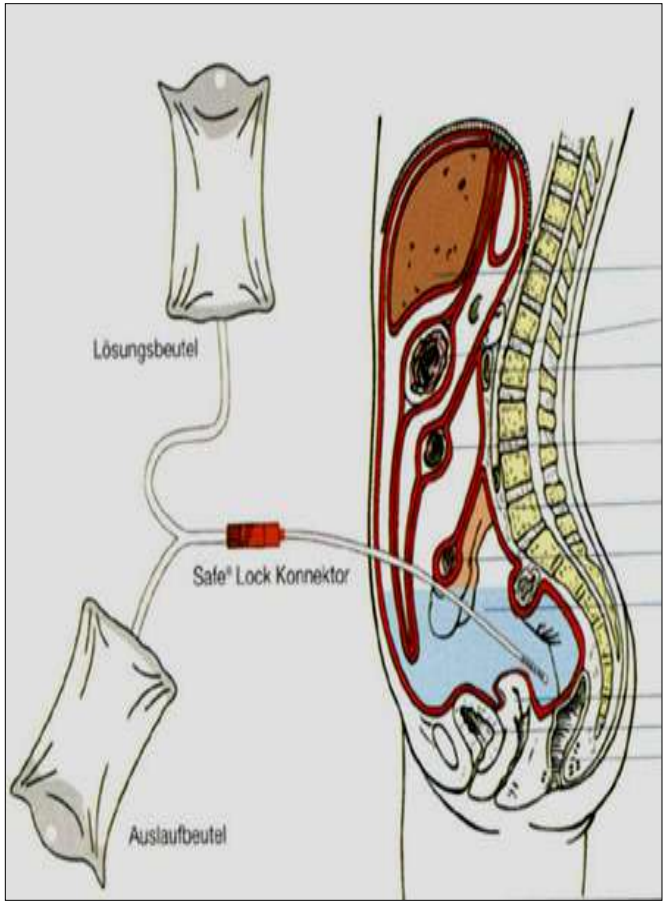
Diabetes as the primary diagnosis of incident renal replacement treatment patients in 2000



Locatelli F et al. JASON 2004; 15:S25-29

Principles of PD

- **Dialysis fluid** is introduced to the **peritoneal cavity** through a catheter placed in the lower part of the abdomen.
- peritoneum serves as the **dialysis membrane**. The peritoneal cavity can often hold more then 3 litres, but in clinical practice only 1.5 – 2.5L of fluid are used.
- Solutes are transported across the membrane by **diffusion**.
- Fluid is removed by **ultrafiltration** driven by an osmotic pressure gradient.



PD fluids

Glucose :

- Glucose was the only osmotic agent available until 1990.
- It is not directly toxic, effective and inexpensive available in con. 1.36% 1.5% 2.2% 3.86 and 4.25% with high glucose concentration is used for effective UF

Diabetes mellitus and PD:

Glucose Degradation Products (GDPs) Identified in Peritoneal Dialysis Solutions

GDP	Concentration (µmol/L)
Acetaldehyde	120–420
Formaldehyde	6–15
2-Furaldehyde	0.05–2
Glyoxal	3–14
5-Hydroxymethyl furaldehyde	6–30
Methylglyoxal	2–23
Valeraldehyde	ND
3-Deoxyglucosone	118–154
3,4-Dideoxyglucosone-3-ene	9–22

Sitter T.PDI 2005; 25;415-25

New PD solutions

Physioneal

- ↓ Infusion pain
- ↓ Peritonitis
- ↑ Glycemic control
- ↑ Appetite
- ↑ Patient acceptance
- No ↓ UF

Icodextrin

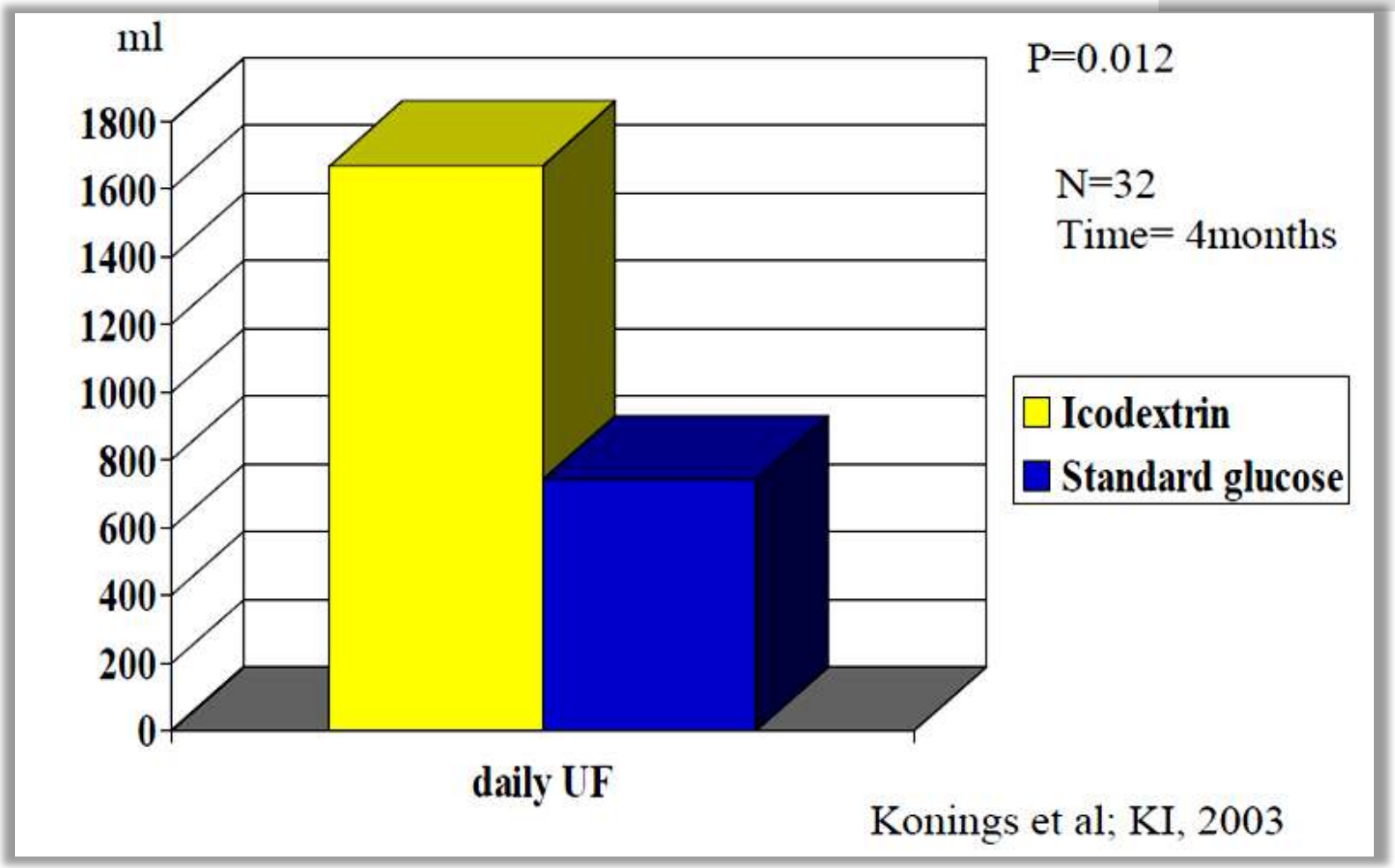
- ↓ Glucose load
- ↑ Glycemic control
- ↑ UF, control of fluid status
- ↓ Dyslipidemia
- ↑ Quality of life
- ↑ Time on PD

Nutrineal

- ↓ Glucose load
- ↑ Glycemic control
- ↑ Protein intake, nutritional status

Pecoits-Filho, et al. *Kidney Int*. 2003;64(suppl 88):S100-S104.
Vardhan, et al. *Kidney Int.* 2003;64(suppl 88):S114-S123.

Icodextrin and fluid status



Icodextrin Eliminates Phosphate and Ameliorates Cardiac Hypertrophy and Valvular Calcification in Patients with End-Stage Renal Disease and Diabetes Mellitus Undergoing Peritoneal Dialysis

Takeyuki Hiramatsu,[1] Takahiro Hayasaki,[1] Akinori Hobo,[1] Shinji Furuta,[1] Koki Kabu,[2] Yukio Tonozuka,[2] Yoshiyasu Iida[1]

Conclusions

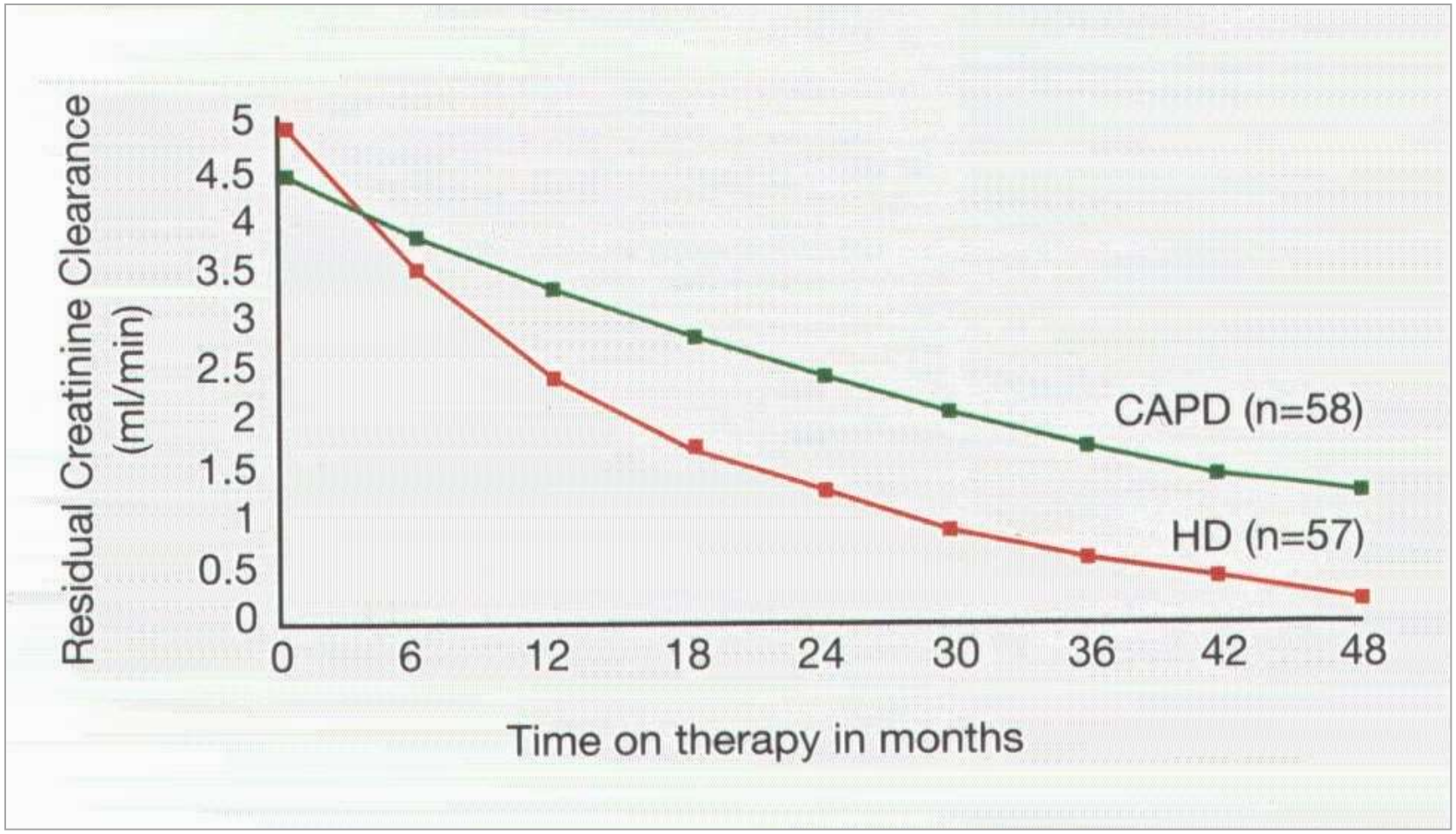
The present study suggests that Ico not only induces greater fluid removal and improves residual renal function, but that it also ameliorates cardiac hypertrophy and valvular calcification in PD patients with DM and high peritoneal membrane transport.

Advances in Peritoneal Dialysis, Vol. 29, 2013

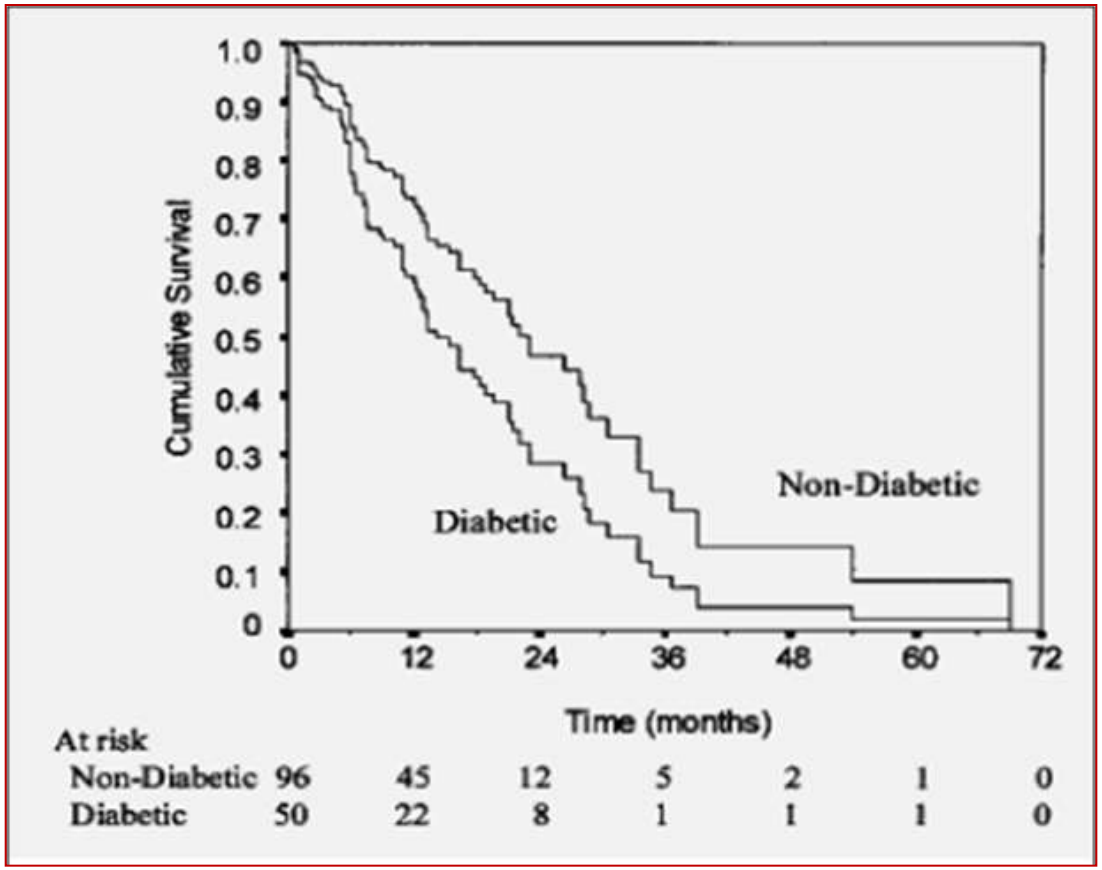
Diabetes mellitus and Peritoneal Dialysis: potential advantages

- No need for vascular access
- No need for systemic anticoagulation
- Continuous therapy
- Gradual ultra filtration
- Better preservation of renal function
- Fewer episodes of hypotension
- Better control of anemia
- Lifestyle advantages
- More liberal diet

Diabetes and peritoneal dialysis: What about RRF?

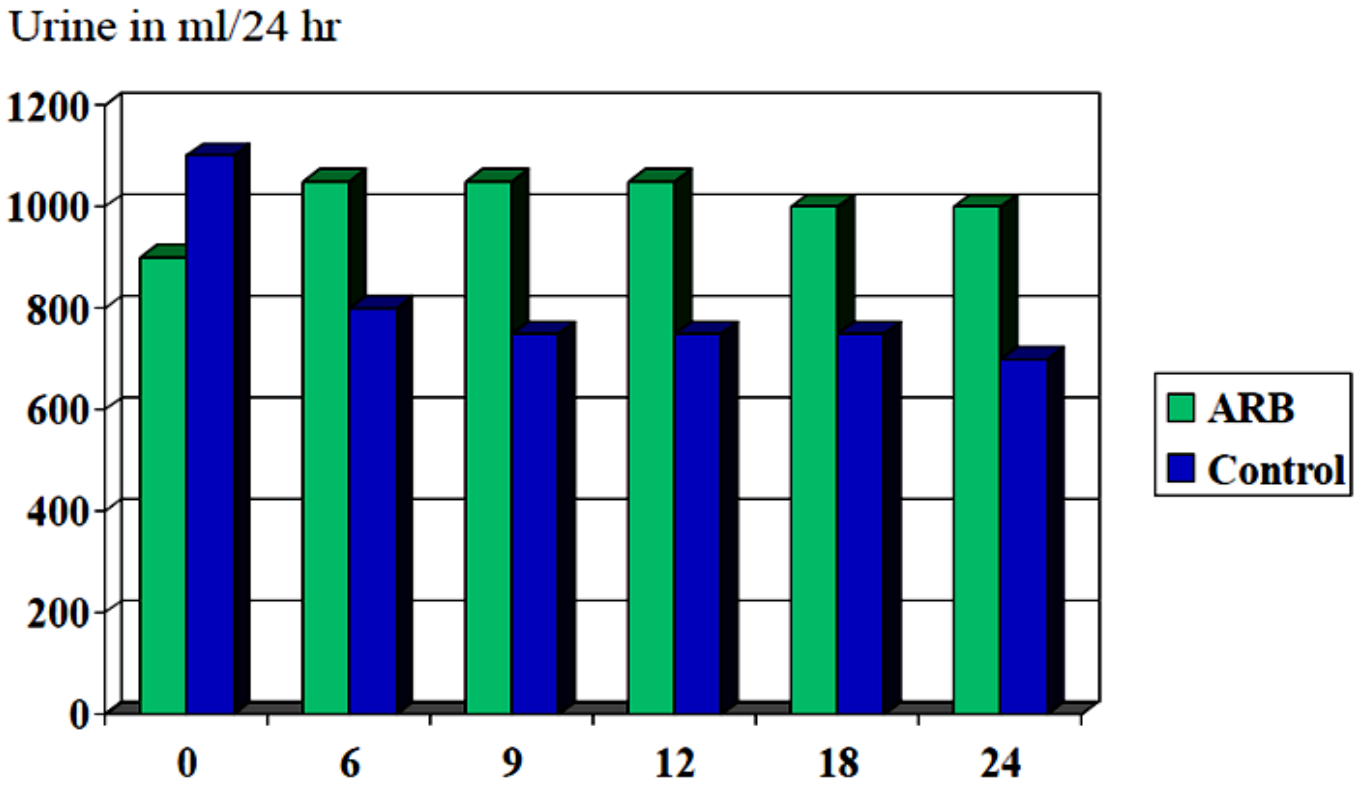


Diabetes and peritoneal dialysis: What about RRF?



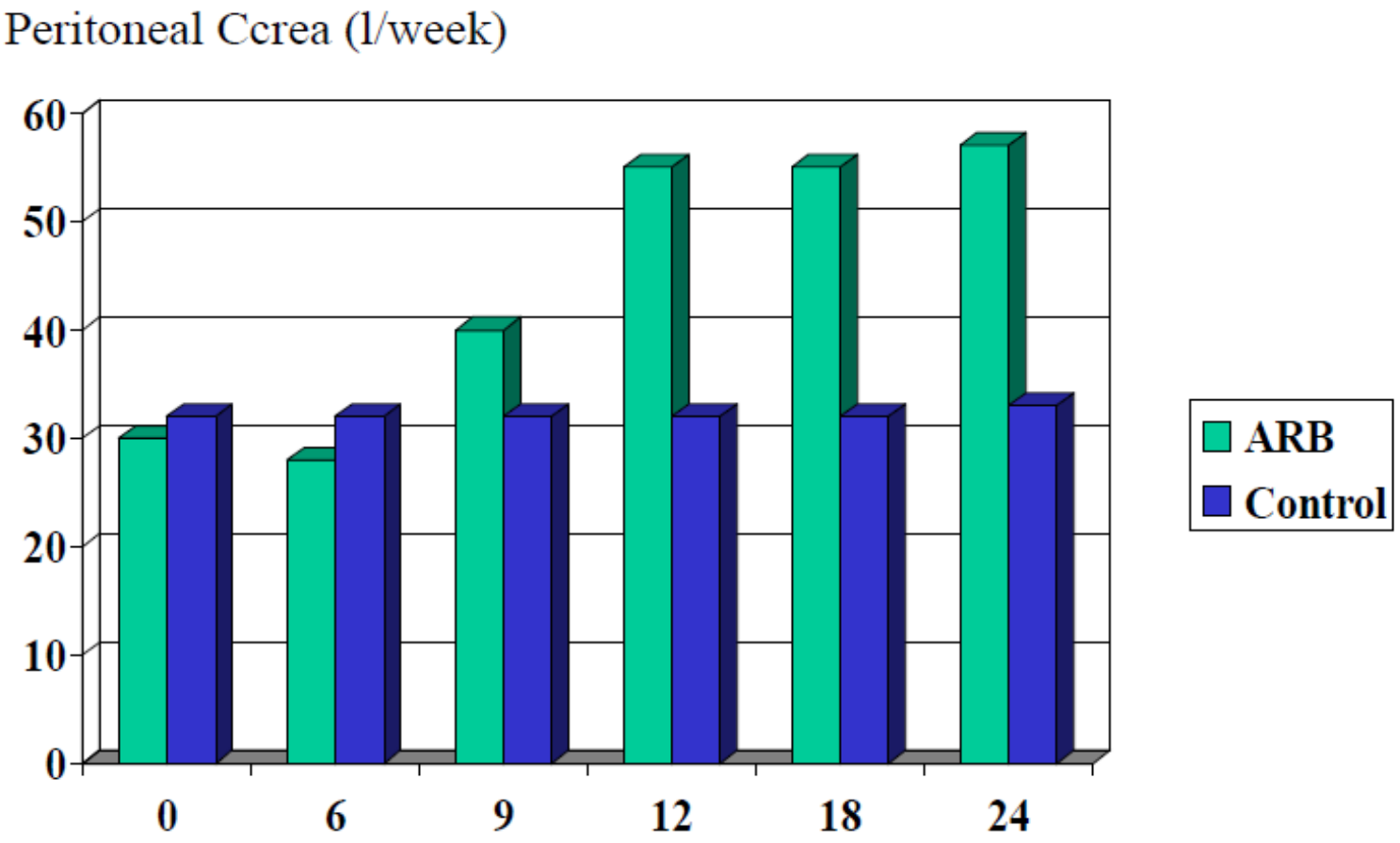
Johnson, PDI 2003;23:276-83

ARB's and PD and RRF



Suzuki et al, AJKD, 43,1056

ARB's and PD and RRF

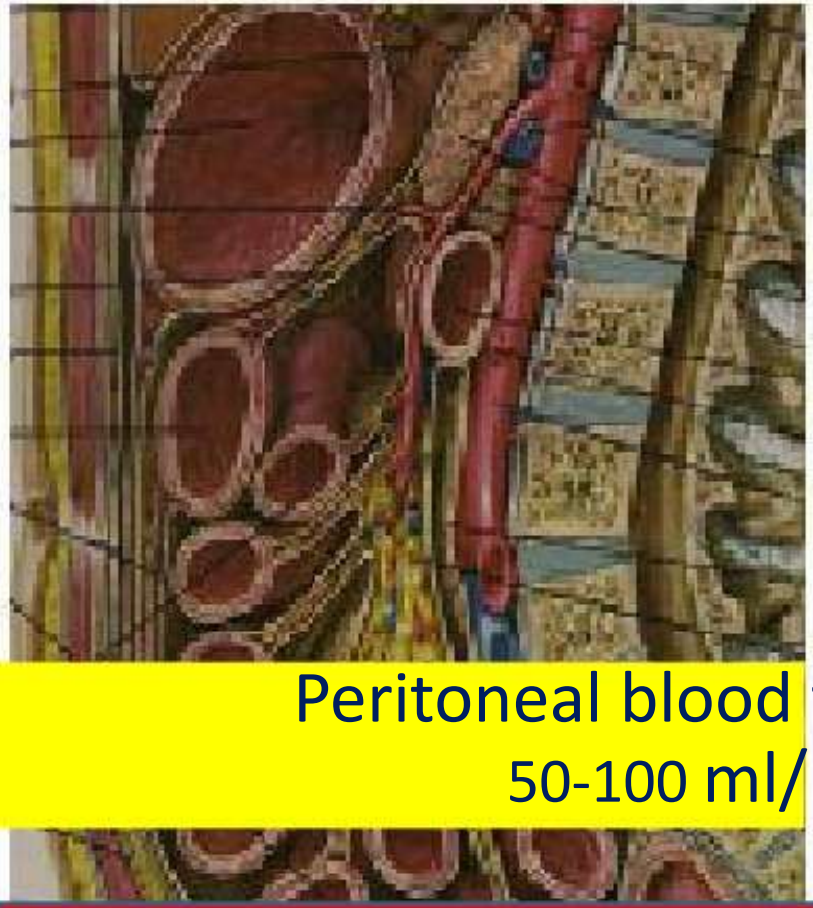


Suzuki et al, AJKD, 43,1056

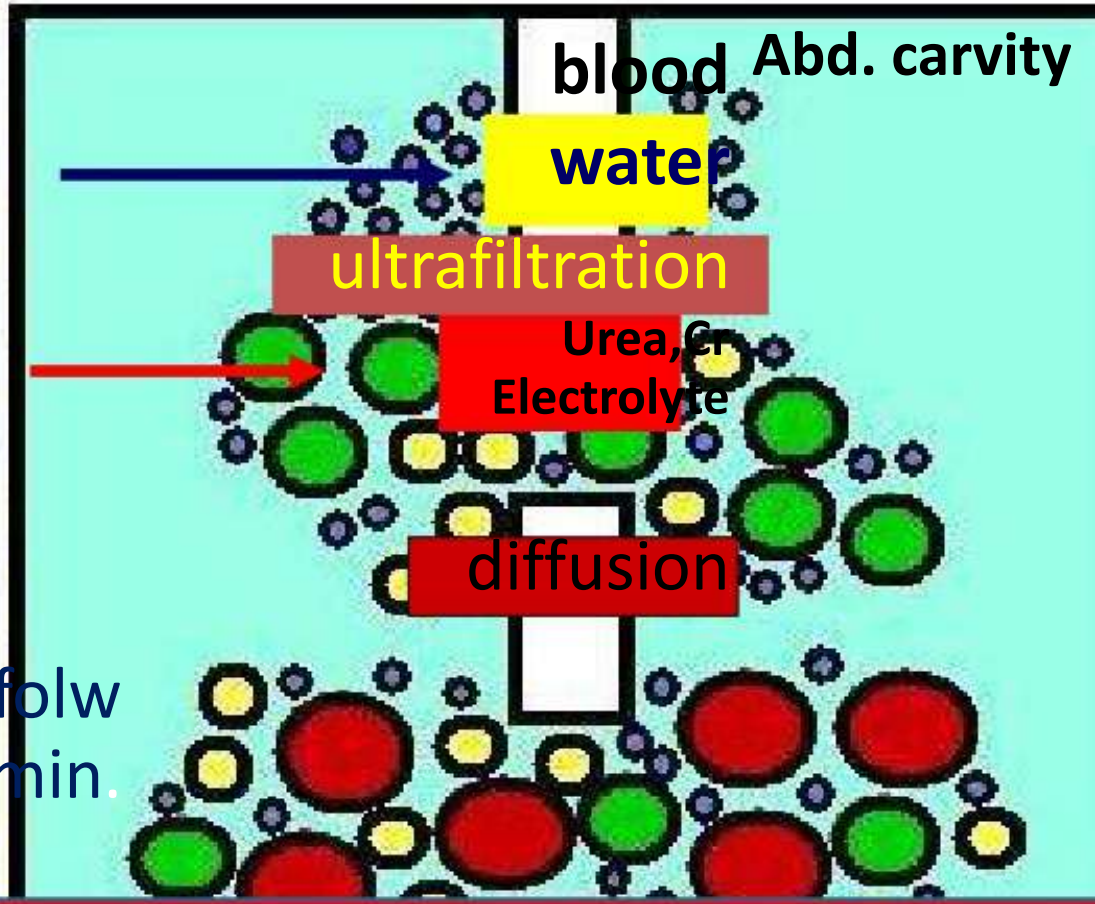
PD in diabetics: concerns

- About Differences in peritoneal membrane structure?
- Higher peritonitis rates?
- About morbidity and mortality

Physiology of Peritoneal Transport

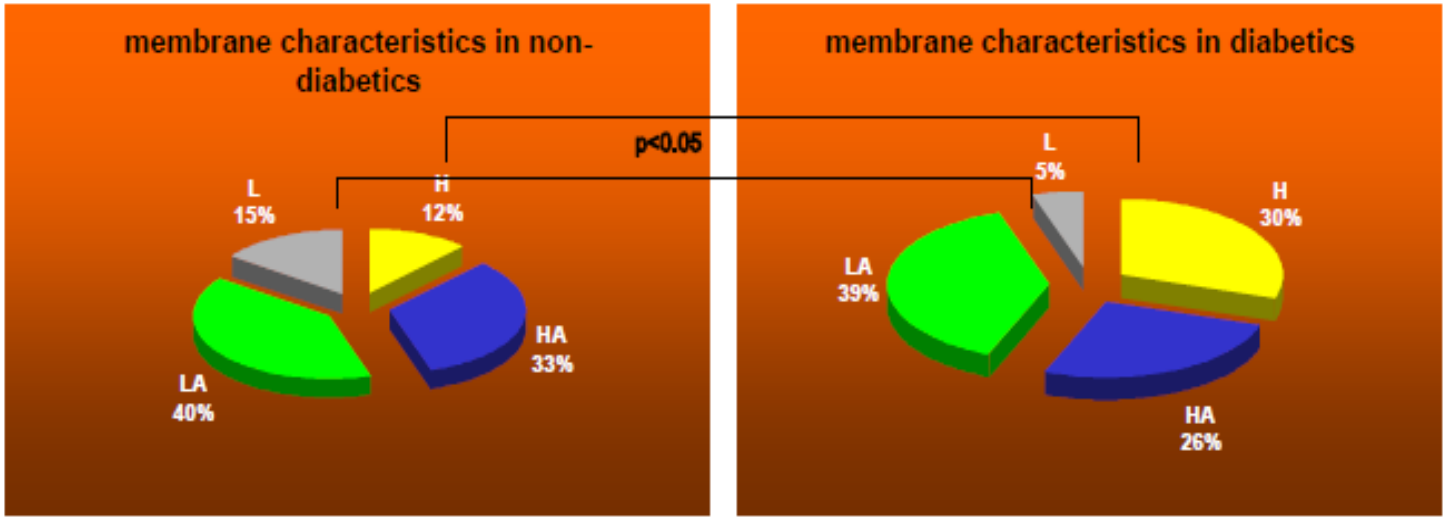


Peritoneal blood folw
50-100 ml/min.



Diffusion is depend on dialysate
not depend on peritoneal blood flow

Diabetes and peritoneal membrane characteristics



Correa-Rotter, PDI 2001;S3:S75-79

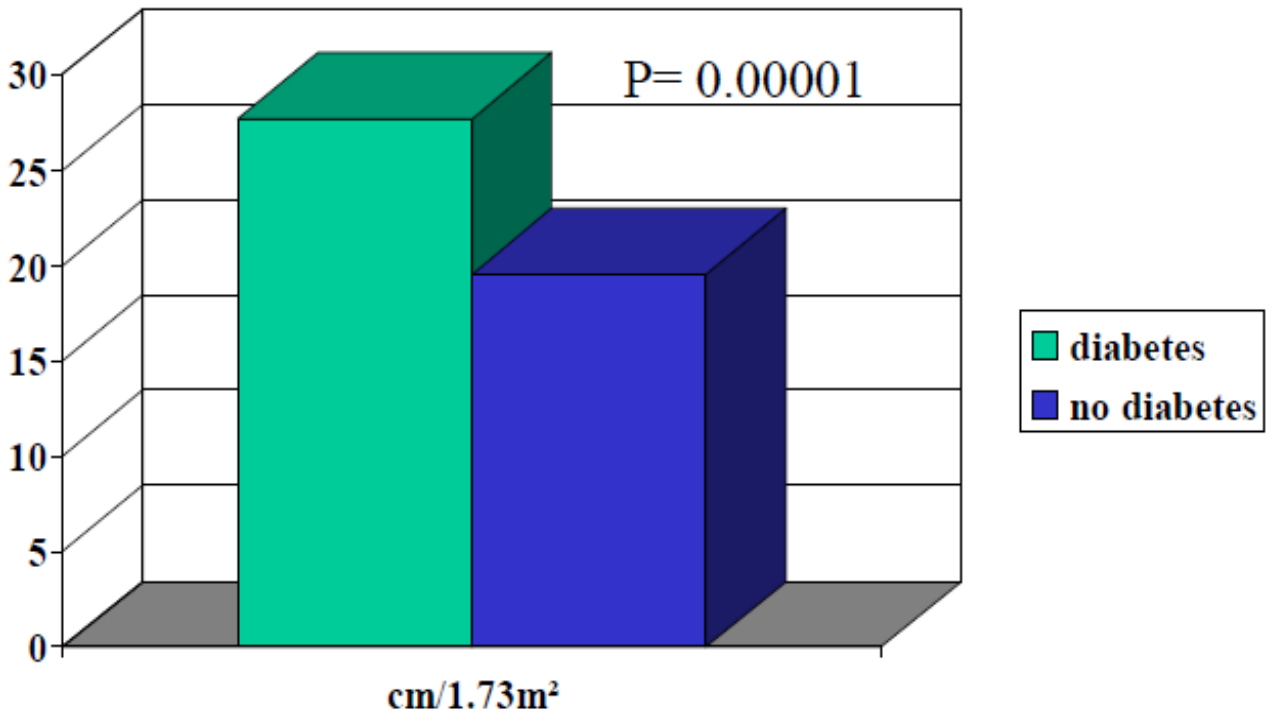
Mind!

Protein losses

Fluid overload

Glucose absorption

PDC- Surface area diabetics vs non diabetics



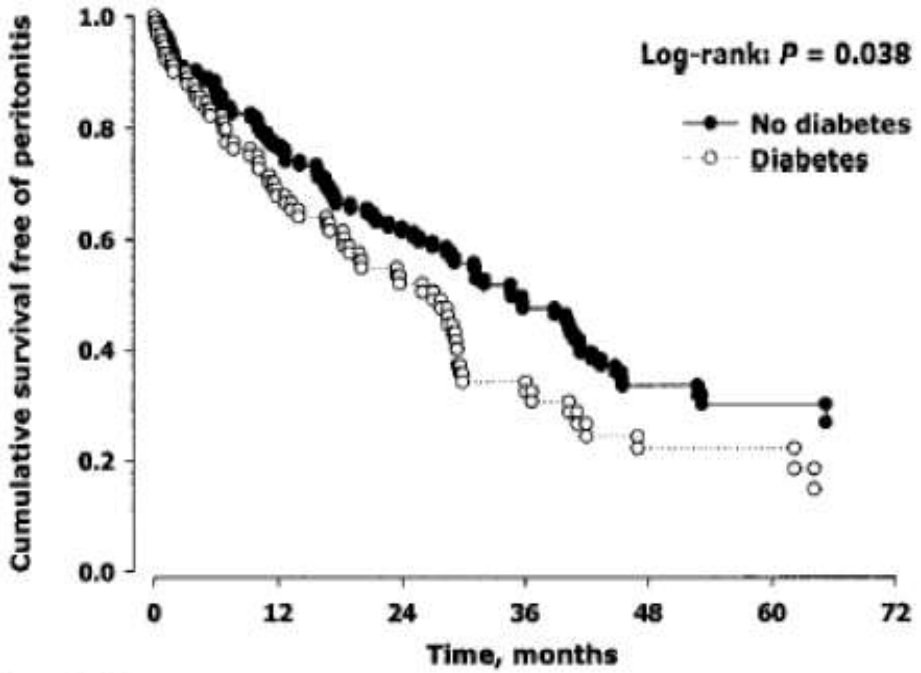
Nakamoto et al, AJKD, 2002

PDC- parameters
diabetics *vs* non diabetics

- Diabetic patients probably
- have a larger vascular surface area, potentially related to neo-angiogenesis
- have a more leaky membrane,
- probably due to interstitial damage

Nakamoto *multiplied by 10 et al, AJKD, 2002

Diabetes mellitus and PD peritonitis



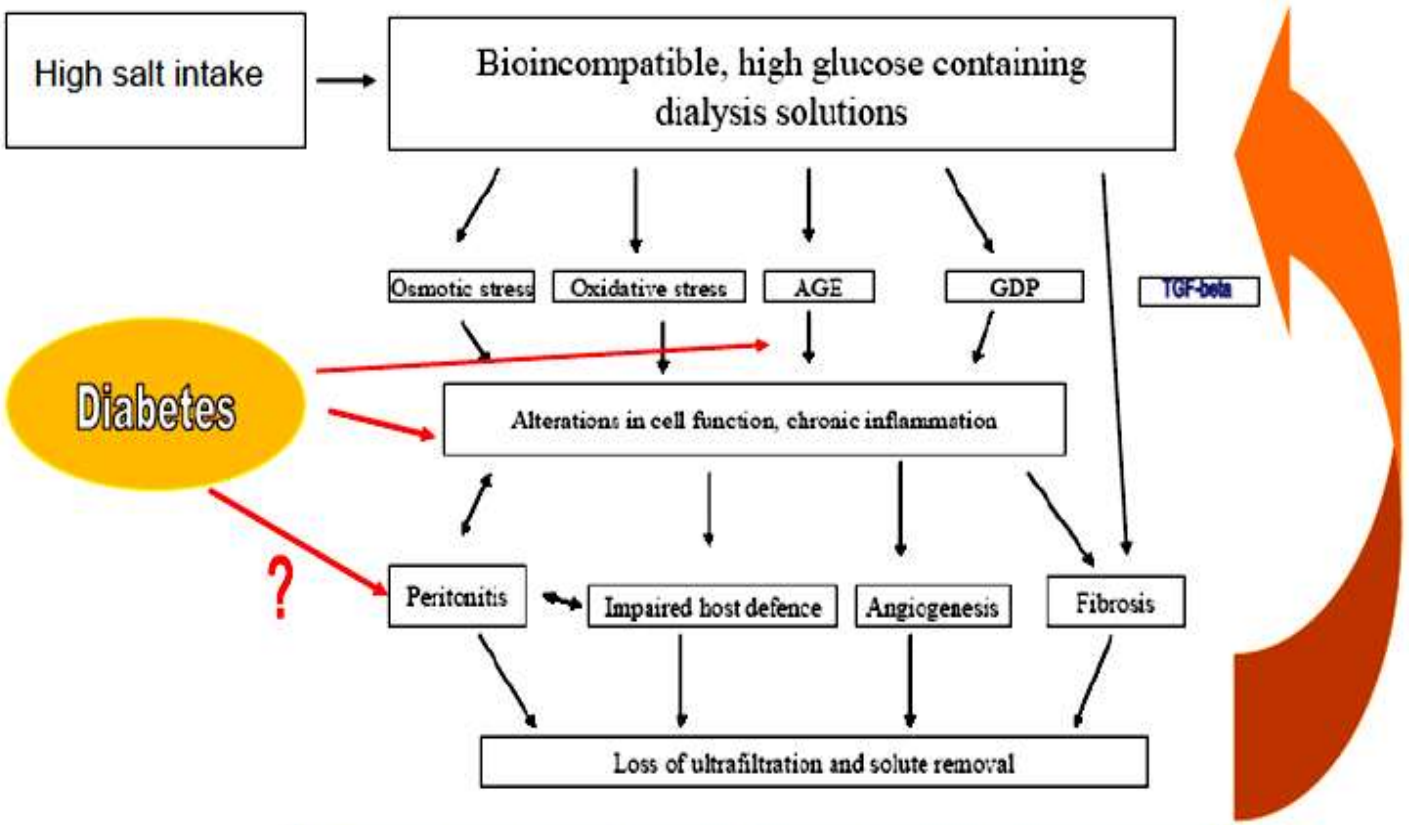
Number at risk:				
No diabetes	155	70	24	5
Diabetes	89	36	10	1

Chow KM, PDI 2005;25:374-379

Diabetes and peritonitis risk

Reference	Population	Infection free time (mths)	RR diabetics
Oo et al, AJKD 2004	USRDS	17.7 vs 15.8	1.13
Chow et al, PDI 2005	Hong Kong	82.3 vs 49.0	1.5
Lim et al, Nephrology 2005	ANZDATA	Not given	NS
Wang Q et al, AJKD 2003	Pensylvania	Not given (rate 0.65/year)	NS

Diabetes mellitus and PD: determinants of survival: the role of inflammation??



Changing peritoneal membrane: after several months on PD: thickening of basal membrane in 26% of diabetics versus 5.6% of non-diabetics

Peritonitis in diabetic PD patients

Cave diabetic rethinopathy and polyneuropathy: importance of the connectology and training

CJASN Clinical Journal of the American Society of Nephrology

Comparing Mortality of Peritoneal and Hemodialysis Patients in the First 2 Years of Dialysis Therapy: A Marginal Structural Model Analysis

Lilia R. Lukowsky,[*†] *Rajnish Mehrotra,*[‡] *Leeka Kheifets,*[†] *Onyebuchi A. Arah,*[†§‖] *Allen R. Nissenson,*[¶**] *and Kamyar Kalantar-Zadeh*[*†¶]

Conclusions

Peritoneal dialysis seems to be associated with 48% lower mortality than hemodialysis over the first 2 years of dialysis therapy independent of modality switches or differential transplantation rates.

Clin J Am Soc Nephrol 8: 619–628, 2013.

Risk factors for mortality in diabetic peritoneal dialysis patients

Sung Hee Chung[1,3], Dong Cheol Han[1], Hyunjin Noh[1], Jin Seok Jeon[1], Soon Hyo Kwon[1], Bengt Lindholm[3] and Hi Bahl Lee[1,2]

[1]Hyonam Kidney Laboratory, Soon Chun Hyang University, Seoul, Korea, [2]Kim's Clinic and Dialysis Unit, Miryang, Korea and [3]Baxter Novum and Renal Medicine, Karolinska Institutet, Stockholm, Sweden

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Abstract

Background. It is well established that the survival rate of diabetic end-stage renal disease patients remains the lowest among all primary diagnoses probably because of higher prevalence of cardiovascular diseases (CVD) associated with diabetes. This study was designed to evaluate the impact of CVD and other risk factors individually or in combination on mortality in diabetic peritoneal dialysis (PD) patients.

Methods. In a retrospective study, 213 incident PD patients [118 had diabetes mellitus (DM), 94 were female, mean age 55 ± 13 years] underwent initial assessment of nutritional status, comorbid disease (CMD) survey, residual renal function (RRF), dialysis adequacy and peritoneal rate in diabetic PD patients, in particular among female patients, was mainly attributable to concurrent morbidity such as CVD and PEW, together with low RRF.

Keywords: cardiovascular disease; diabetes; mortality; peritoneal dialysis; protein-energy wasting

Introduction

Nephrol Dial Transplant (2010) 25: 3742–3748 doi: 10.1093/ndt/gfq233 Advance Access publication 5 May 2010

Risk factors for mortality in diabetic peritoneal dialysis patients

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In conclusion, this study shows that high mortality in diabetic PD patients is due to a combination of old age, CVD, PEW, female gender and low RRF whereas DM *per se* was not an independent risk factor in this group of PD patients. Among all the patients, female DM patients had the highest mortality which was associated with high prevalence of CVD and PEW and low RRF.

Nephrol Dial Transplant (2010) 25: 3742–3748 doi: 10.1093/ndt/gfq233 Advance Access publication 5 May 2010

Glycemic Control and Survival in Peritoneal Dialysis Patients with Diabetes Mellitus

Uyen Duong, Rajnish Mehrotra,†‡ Miklos Z. Molnar,*§ Nazanin Noori,* Csaba P. Kovesdy,‖¶ Allen R. Nissenson,‡** and Kamyar Kalantar-Zadeh,*‡‡ ††*

Summary

Background and objectives The optimal target for glycemic control has not been established for diabetic peritoneal dialysis (PD) patients.

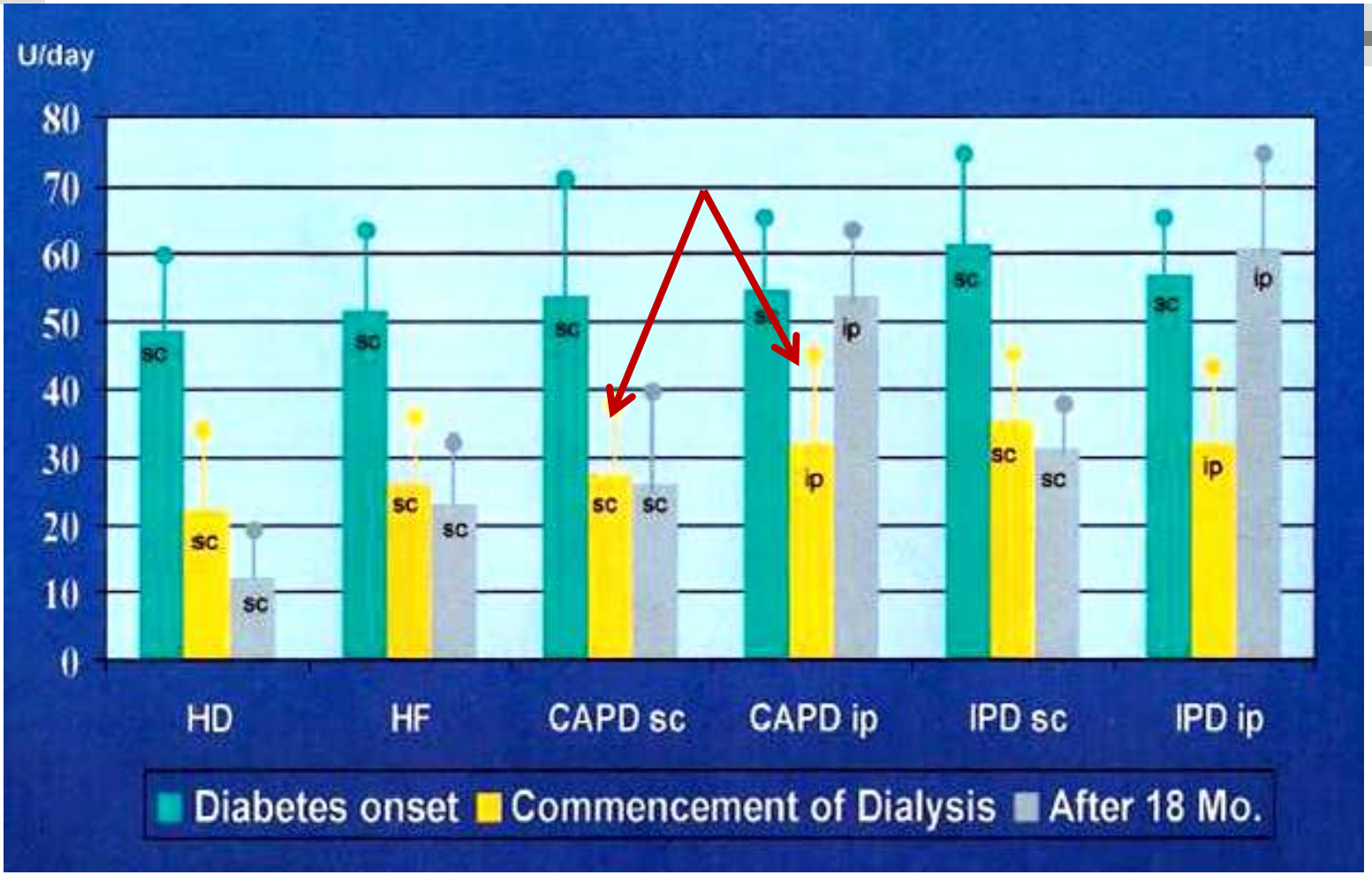
Design, setting, participants, & measurements We examined mortality-predictability of hemoglobin A1c random serum glucose in a contemporary cohort of diabetic PD patients treated in DaVita dialysis clinics July 2001 through June 2006 with follow-up through June 2007.

Results We identified 2798 diabetic PD patients with A1c data. Serum glucose correlated with A1C ($r = 0.51$). Adjusted all-cause death hazard ratio and 95% confidence interval for baseline A1c increments of 7.0 to 7.9%, 8.0 to 8.9%, 9.0 to 9.9%, and ≥10%, compared with 6.0 to 6.9% (reference), were 1.13 (0.97 to 1.32), 1.05 (0.88 to 1.27), 1.06 (0.84 to 1.34), and 1.48 (1.18 to 1.86); and for time-averaged A1c values were 1.10 (0.96 to 1.27), 1.28 (1.07 to 1.53), 1.34 (1.05 to 1.70), and 1.81 (1.33 to 2.46), respectively. The A1c-mortality association was modified by hemoglobin level such that higher all-cause mortality was evident only in non-anemic patients. Similar but non-significant trends in cardiovascular death risk was found across A1c increments. Adjusted all-cause death HR for time-averaged blood glucose 150 to 199, 200 to 249, 250 to 299, and ≥300 mg/dl, compared with 60 to 99 mg/dl (reference), were 1.02 (0.70 to 1.47), 1.12 (0.77 to 1.63), 1.45 (0.97 to 2.18), and 2.10 (1.37 to 3.20), respectively.

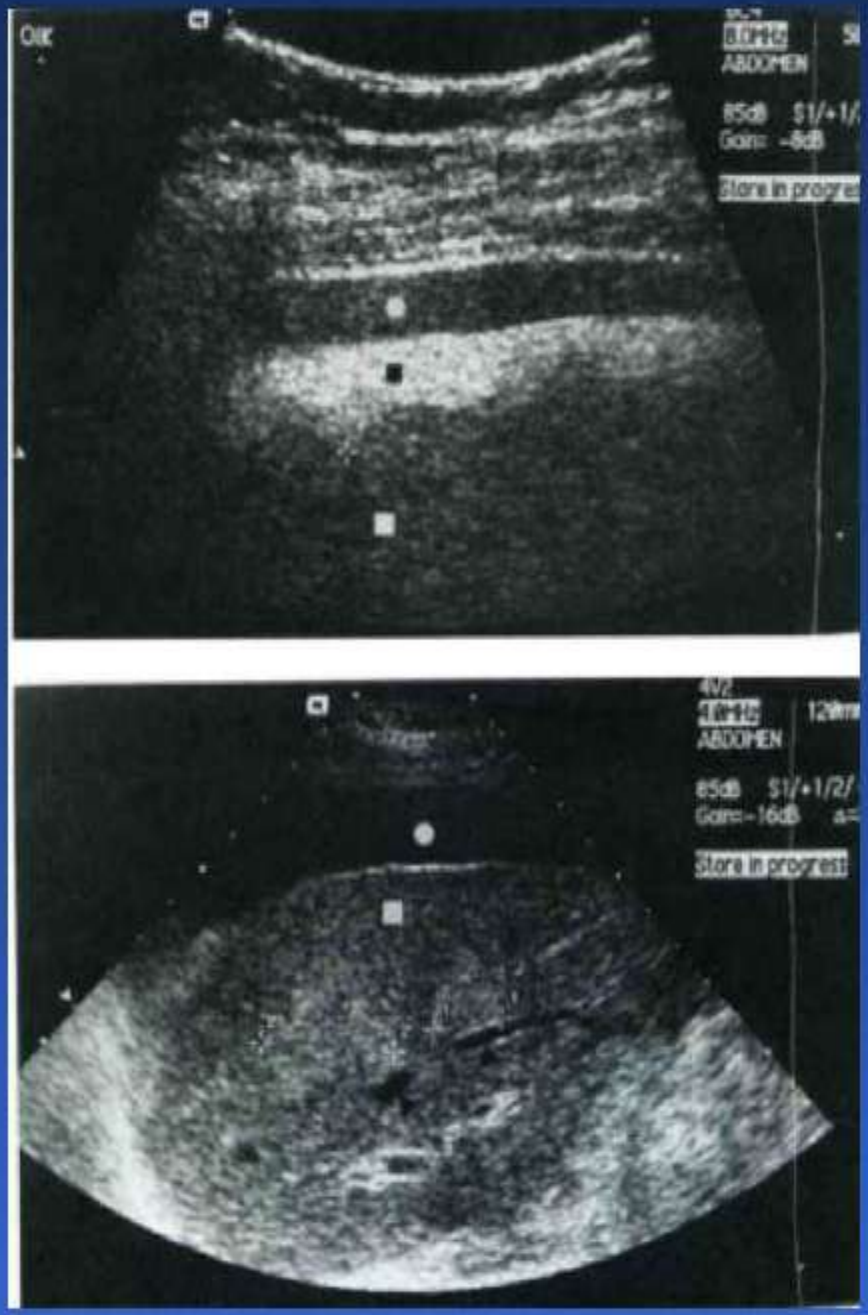
Conclusions Poor glycemic control appears associated incrementally with higher mortality in PD patients. Moderate to severe hyperglycemia is associated with higher death risk especially in certain subgroups.

Clin J Am Soc Nephrol 6: 1041–1048, 2011. doi: 10.2215/CJN.08921010

Insulin therapy in ESRD



Quellhorst et al, JASN 2002



Hepatic subcapsular (upper) and intrahepatic steatosis (lower) after ip insulin

sc n=8, 0/8

ip n=8, 7/8

PDI 20 (6): 637-642, 2000.

Impact of education on diabetic compliance

Intensive counseling of diabetic patients on PD :

- ✓ Importance of salt restriction
- ✓ Importance of glucose monitoring
- ✓ Deleterious effect of high glucose solutions

Quan and Wang T. et al, PDI 2006

Impact of education on diabetic compliance

After 1 year:

- ✓ Compliance to salt restriction increased from 19.5 to 76.2 %
- ✓ Only 3/31 used 2.5% and 1/31 used 4.25%
- ✓ Fluid status improved as measured by bio-impedance measurement

Quan and Wang T. et al, PDI 2006

Review Article

Peritoneal Dialysis in Diabetics: There Is Room for More

P. Cotovio,[1] A. Rocha,[2] and A. Rodrigues[2]

[1] *Nephrology Department, Centro Hospitalar de Coimbra (CHC), Quinta dos Vales, 3041-801 S. Martinho do Bispo, Portugal*
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End stage renal disease diabetic patients suffer from worse clinical outcomes under dialysis-independently of modality. Peritoneal dialysis offers them the advantages of home therapy while sparing their frail vascular capital and preserving residual renal function. Other benefits and potential risks deserve discussion. Predialysis intervention with early nephrology referral, patient education, and multidisciplinary support are recommended. Skilled and updated peritoneal dialysis protocols must be prescribed to assure better survival. Optimized volume control, glucose-sparing peritoneal dialysis regimens, and elective use of icodextrin are key therapy strategies. Nutritional evaluation and support, preferential use of low-glucose degradation products solutions, and prescription of renin-angiotensin-aldosterone system acting drugs should also be part of the panel to improve diabetic care under peritoneal dialysis.

SAGE-Hindawi Access to Research International Journal of Nephrology Volume 2011, Article ID 914849, 10 pages doi:10.4061/2011/914849

Review Article

Peritoneal Dialysis in Diabetics: There Is Room for More

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Received 26 February 2011; Revised 5 July 2011; Accepted 15 August 2011

7. Conclusion

Diabetes is among nephrological causes of ESRD that are associated with the worst diagnosis. Independently of the renal replacement therapy patient survival is limited and exposed to higher rate of complications and hospitalizations. PD however, offers a cluster of advantages in diabetic patients: besides amenable better life-style the modality avoids vascular access complications in patients with frail vascular capital, protects RRF, and allows higher hemodynamic stability with less myocardial stress and stunning, with slower progressive retinopathy. The disadvantages can be overcome by adequate care, glucose-sparing PD regimens, optimization of volume control and other protective measures like RAAS acting drugs and antioxidants to prolong the best quality of care while on PD. P. Cotovio and A. Rocha contributed equally to this paper.

SAGE-Hindawi Access to Research International Journal of Nephrology Volume 2011, Article ID 914849, 10 pages doi:10.4061/2011/914849

Conclusion

- **No doubt that diabetes is an evil disease, with negative impact on outcome of ESRD patients**
- **PD in an integrated care approach is a suitable alternative for diabetics**
- **<u>Attention to</u>**
  - preservation of RRF
  - Blood Sugar control
  - Use of ARABs
  - Low –GDP mandatory
  - Patient education and training

Thank YOU

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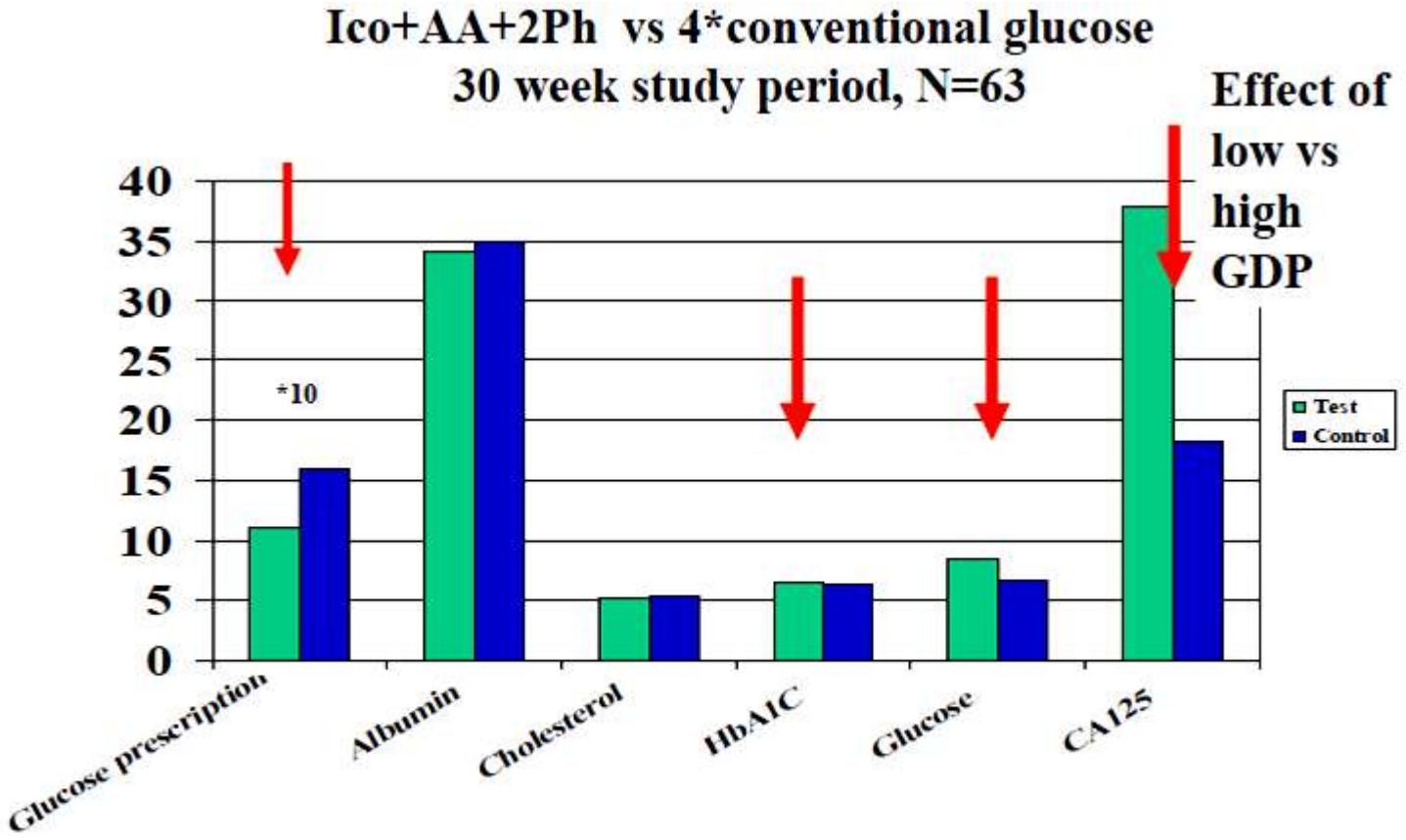
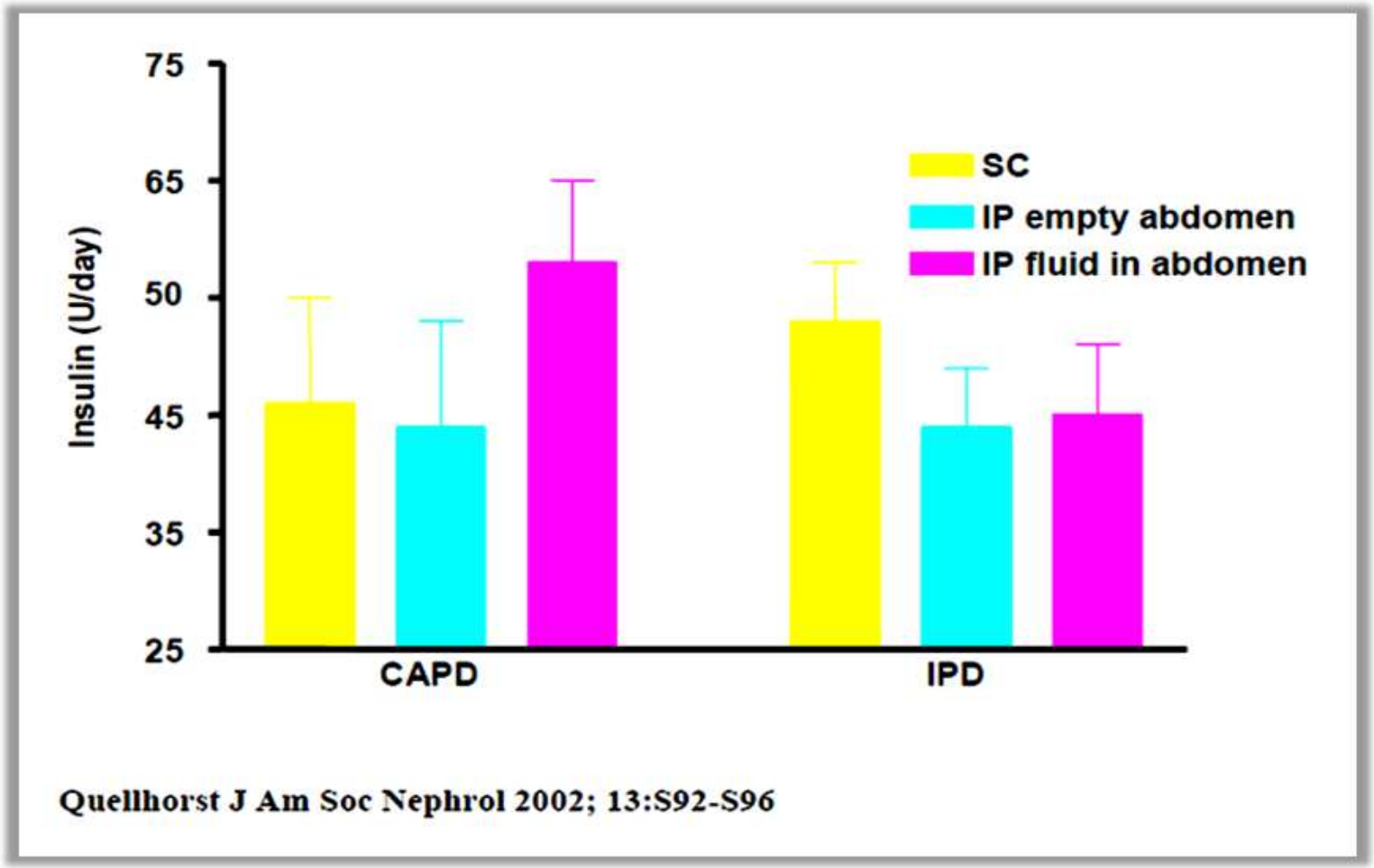
Do glucose free solutions lead to better glycemia control?



Ter Wee et al, PDI, 2005, S3, S64

Daily insulin requirements for diabetic patients on peritoneal dialysis



Quellhorst J Am Soc Nephrol 2002; 13:S92-S96